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A VERNIER TREE GROWTH BAND

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In many studies of tree growth there is a definite need for a simple, inexpensive instrument which will accurately measure seasonal tree diameter growth. In addition to total increment for the season, is is often important for an investigator to determine the date on which diameter increment started, the rate of acceleration during the growing season, and the date of cessation of growth. Several such instruments have been proposed for the purpose, but for the most part, have been rather complicated or expensive to install and maintain. MacDougal 1/ has developed a dendrograph which meets some of the above

1/ MacDougal, D. T. Growth in Trees. Carnegie Institution of Washington. Publication No. 350. 116 pp. illus. 1924.

requirements, but has the disadvantage of being very expensive and needs considerable attention and adjustment to keep it in proper working order.

Reineke 2/ has developed a precision dendrometer which has proven

2/ Reineke, L. H. A Precision Dendrometer. Jour. of Forestry, Vol. XXX, No. 6, pp. 692-699. October, 1932.

to be quite satisfactory, but has the disadvantage that it measures growth only at a very limited portion of the annual ring over which a contact is made. It is the purpose of this paper to describe an instrument which has been used with considerable success by the writer in ecological work with certain wood and bark boring insects.

The Instrument

This instrument consists of a band of aluminum coil encircling the tree and held firmly in place by a coil spring at the point where a measurement is desired. The band is graduated into circumference inches and tenths, fitted with a vernier which permits a reading to .01 of an inch - Figure 1.

Materials Used

Band and Vernier

Aluminum was selected for this purpose for three reasons:

1. It is flexible and easily worked with simple tools and fits closely to the tree trunk.

2. It has the property of reflecting a large proportion of the heat rays which strike it and does not become hot when exposed to the rays of the sun.

3. It also does not deteriorate when exposed to outdoor conditions.

Figure 1

Vernier Tree Growth Band

While the co-efficient of expansion for aluminum is relatively high, it does not effect this instrument to any important degree. The maximum error due to this source during a normal growing season for a 24-inch band would not greatly exceed .01 of an inch. This error is also somewhat compensating in that the co-efficient of expansion of the wood of the tree closely approximates that of the band.

The gauge of aluminum which has proven most satisfactory has been #30, .01 of an inch thick and one inch wide. One pound of aluminum will make approximately 40, 24-inch bands.

Springs

Stainless steel has proven to be the most satisfactory material tested for the purpose. No. 73 wire, 0.024 inch in diameter, is a satisfactory weight. A considerable economy was realized on this item by buying the wire by the pound and then having the springs wound on a lathe. One pound of this wire will make approximately 160 springs one-fourth inch in diameter and 1½ inches long.

Making and Graduating the Bands and Vernier

The bands and verniers are made of separate pieces and later riveted together with a tape mending outfit. This permits the proper fit for each individual tree and makes possible the extension of the band, by splicing in additional sections, when the tree has grown to the limit of the graduations.

The band and the vernier are run through separate templates where the graduation and numbers are placed on them. The graduations are scratched on with a glass cutter and the number stamped on with metal die. The vernier is graduated with the zero observation point to the left and the band graduated from left to right. This point is a matter of personal preference in that it simplifies later computation. The lower portion of the vernier is removed so as to permit easy reading of the band. About an inch space is allowed on the extreme end of the vernier for the band number and spring hook. This hook is made by cutting a "V" shaped piece at the extreme right end of the vernier and then bending the piece back over a piece of wire about the diameter of a paper clip to hold one end of the spring. A rectangular tab one-fourth inch wide and 2 inches long is allowed on the extreme end of the band. This permits pulling the band tight at the time the spring is applied. Two small pieces of aluminum about ¼ inch wide and 1½ inches long are cut to act as riders between the tree and the band.

Fitting the Band to the Tree

The first operation consists of shaving off the rough portion of the bark with a knife or draw shave at the point where the band is to be placed and then smoothing the surface with a long narrow band of sand paper or emery cloth until the band will fit uniformily around the whole circumference. The band is then placed around the tree and marked for splicing with the vernier as far to the right as possible. About one-fourth of an inch should be allowed for splicing. The vernier is then spliced to the band by riveting with a tape mending outfit, with care exercised to be sure the two are in proper aligment. The band is then placed around the tree and the leader run through the opening between the rivets, over the band itself and under the vernier and protruding to the outside. The springs are then attached to the vernier and the band pulled tight. The other end of the spring is then attached to the band by cutting out a "V" shaped notch with a sharp knife with the points of the "V" to the left. This is bent over a paper clip and the spring attached. The spring should be fitted so that there is a sufficient tension on the band to hold it tight. An inch and one-half spring extended to two inches will usually give the necessary tension. The last step is to place the two narrow strips of aluminum between the band and the tree with the two ends bent over. One should be placed at the extreme right of the vernier and the other well to the left of the vernier. These strips act as guides to keep the vernier and band in proper aligment. See Figure 1. It takes approximately twenty minutes to complete all of the above operations for each tree.

Reading the Instrument

The band is read like any vernier scale. The instrument is read after fitting and the initial point recorded. Each succeeding reading is subtracted from the previous figure with this difference representing the increments for that interval. It was found that weekly readings during the growing season gave satisfactory data for the construction of a growth curve for the season. See Figure 2. The instrument is graduated into circumference inches and for the purpose of the graph in Figure 2, these were converted into diameter increment.

Screening the Instrument

At first considerable trouble was experienced with this band from woodpecker damage. They appear to be attracted by this shiny object, and unless the band is protected, they often will completely perforate it. This difficulty was overcome by placing a narrow band of 16 mesh screen around the band and held out from the tree with four 1-inch wooden blocks. A small hole over the vernier was cut to permit the easy reading of the scale.

Cost of the Instrument

The approximate cost of the band and vernier material is one cent each for a six-inch tree. The cost of the templates, steel dies and marker was $16.00. The cost of the springs is approximately two cents each which includes the labor of winding the springs.

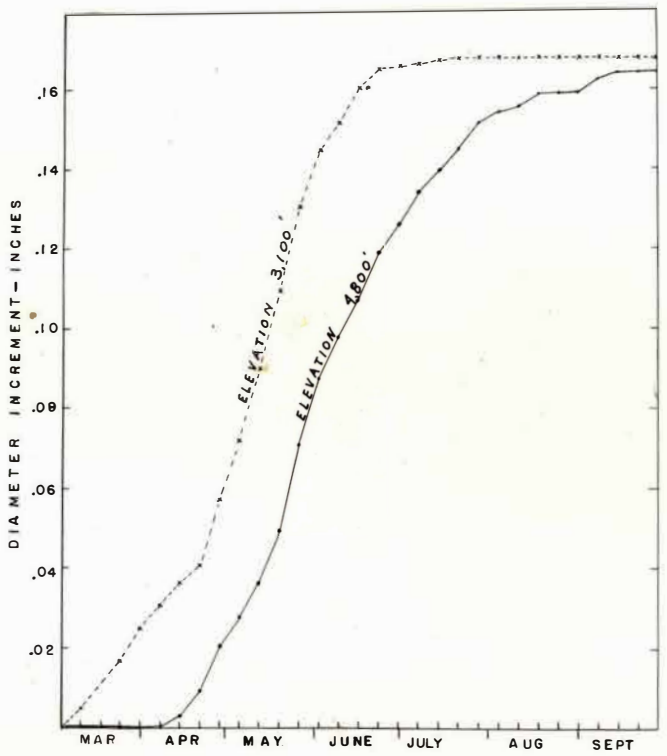

Figure 2

Seasonal diameter increments of ponderosa pine at two elevations on the Lassen National Forest for the 1940 season. Data obtained from vernier tree growth bands.